



Fayoum University
Faculty of Education
Department of Curricula and Methodology (Educational Technology)

**The Impact of Interaction between Source and Design Patterns
of Scaffolding in an E-Learning Environment Based on
Gamification on Developing Educational Technology Students'
Skills of Producing Interactive Infographic**

A Ph.D. Thesis in Education with a Major in Educational Technology

Submitted by

Ahmed Mahmoud Saleh Ahmed

Teaching Assistant of Educational Technology
Faculty of Specific Education-Fayoum University

Under the Supervision of

Prof. Amal Rabea Kamel

Professor of Curricula and Methodology
of Science, Former Dean of Faculty of
Education- Fayoum University

Prof. Eman Salah El Deen Saleh

Professor of Educational Technology
Former Vice Dean of Faculty of
Education-Helwan University

Dr. Hamdy Ahmed Abdel Azeem

Lecturer in Educational Technology
Faculty of Specific Education-Fayoum University

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Research Summary

The current research investigates the impact of interaction between source and design patterns of scaffolding in an e-learning environment based on gamification on developing educational technology students' skills of producing interactive infographic, using four experimental groups (the first experimental group implemented human scaffolding source "teacher" with scaffolding design pattern "Internal") and (the second experimental group implemented the human scaffolding source "teacher" with the "external" scaffolding design pattern), and (the third experimental group implemented the intelligent scaffolding source "chatbots" with the "internal" scaffolding design pattern) and (the fourth experimental group implemented the intelligent scaffolding resource "chatbots" with the "external" scaffolding design pattern).

The research summary includes: the research problem, objective, significance, limitations, sample, method, variables, experimental design, hypotheses, tools, and finally the research procedures and the results as it follows:

Research Problem:

"Weakness of interactive infographics production skills among educational technology students". The current research attempted to treat this problem by revealing the impact of interaction between source and design patterns of scaffolding in an e-learning environment based on gamification on developing

educational technology students' skills of producing interactive infographic

Research Questions:

The current research aims at solving this problem by answering the following main question:

What is the impact of interaction between scaffolding source (human-intelligent) and scaffolding design patterns (internal-external) in an e-learning environment based on gamification on developing educational technology students' skills of producing interactive infographic? **Based on the previous main question, there are the following sub-questions that the study tries to answer:**

- 1- What is the instructional design perception of an e-learning environment based on gamification with scaffolding source (human-intelligent) and scaffolding design patterns (internal-external)?
- 2- What is the impact of interaction between scaffolding source (human-intelligent) in an e-learning environment based on gamification on cognitive aspect of producing interactive infographic skills?
- 3- What is the impact of interaction between scaffolding source (human-intelligent) in an e-learning environment based on gamification on practical performance of producing interactive infographic skills?
- 4- What is the impact of interaction between scaffolding design patterns (internal-external) in an e-learning environment

based on gamification on cognitive aspect of producing interactive infographic skills?

- 5- What is the impact of interaction between scaffolding design patterns (internal–external) in an e–learning environment based on gamification on practical performance of producing interactive infographic skills?
- 6- What is the impact of interaction between scaffolding source (human–intelligent) and scaffolding design patterns (internal–external) in an e–learning environment based on gamification on cognitive aspect of producing interactive infographic skills?
- 7- What is the impact of interaction between scaffolding source (human–intelligent) and scaffolding design patterns (internal–external) in an e–learning environment based on gamification on practical performance of producing interactive infographic skills?

Research Objective:

Providing an educational remedy for the low skill level of producing interactive infographics, in addition to revealing the impact of designing an e–learning environment based on gamification with scaffolding source (human–intelligent) and scaffolding design patterns (internal–external) on developing the skills of producing interactive infographic.

Research Significance:

- The current research may benefit researchers and educational designers by defining the design criteria that should be taken into account when developing e-learning environments based on gamification, and studying the interaction of different types of support and which one is more appropriate and compatible with e-learning environments based on gamification. Also, the current research serves as a reference for subsequent studies of chatbots as a source of intelligent support.
- Educational technology students and professionals may benefit by having content and activities for interactive infographics, which is one of the most important and modern e-learning resources.
- It may help teachers by preparing a list of procedural goals for interactive infographics content, preparing an achievement test to measure the cognitive aspect of interactive infographics production skills, and preparing a test to measure the performance aspect of those skills.
- It may benefit the educational institution by the design and production of an e-learning environment based on gamification, with two sources of support (human, intelligent) and two types of support design (internal, external), with its advantages related to gamification, support, and production skills of interactive infographics which students can acquire through the environment.

Research Limitations:

Content limits:

- E-learning environment based on gamification.

- scaffolding source (human "teacher" – intelligent "Chatbots") and scaffolding design patterns (internal "inside e-learning environment based on gamification" – external "outside e-learning environment based on gamification, in Facebook messenger").
- Infographics production skills (using Articulate Storyline application).

Human and spatial limits:

- Second-year students in the Department of Education Technology, Faculty of Specific Education, Fayoum University, due to the availability of the previous requirements for students.

Time limits:

- The first semester of the academic year 2020/2021 AD – 1441/ 1442 AH.

Research Method:

The current study followed the analytic descriptive method that is related to literary studies and previous studies that have handled the e-learning environment based on gamification, scaffolding source (human "teacher"-intelligent "chatbots") and scaffolding design patterns (internal-external), and the skills of producing interactive infographic. And the quasi-experimental method to experiment the e-learning environment based on gamification and revealing its impact, in view of the multiplicity of scaffolding sources and design patterns, to develop the skills of

producing interactive infographics, and to compare between experimental groups.

Research Variables:

First: Independent Variable:

- scaffolding source (human "teacher"-intelligent "chatbots") in e-learning environment based on gamification.
- scaffolding design patterns (internal-external) in e-learning environment based on gamification.

Second: Dependent Variables:

- cognitive aspect of producing interactive infographic skills.
- practical performance of producing interactive infographic skills.

Experimental Research Design:

Current research used Factorial Design 2×2:

Groups	Pre-Testing	Experimental Treatments	Post-Testing
Group (1)	Cognitive Test + Skills Test	e-learning environment based on gamification with scaffolding source (human), and scaffolding design pattern (internal).	Cognitive Test + Skills Test
Group (2)		e-learning environment based on gamification with scaffolding source (human), and scaffolding design pattern (external).	
Group (3)		e-learning environment based on gamification with scaffolding source (intelligent), and scaffolding design pattern (internal).	
Group (4)		e-learning environment based on gamification with scaffolding source	

Groups	Pre-Testing	Experimental Treatments	Post-Testing
		(intelligent), and scaffolding design pattern (external).	

Research Hypotheses:

1. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with the (human) source of scaffolding, and students who studied in the same environment with the (intelligent) source of scaffolding in the post measurement of Cognitive test of producing interactive infographic skills. This is due to the primary impact of scaffolding source used.
2. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with the (human) source of scaffolding, and students who studied in the same environment with the (intelligent) source of scaffolding in the post measurement of Rubric cards of producing interactive infographic skills. This is due to the primary impact of scaffolding source used.
3. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of

students who studied in an e-learning environment based on gamification with the (internal) design pattern of scaffolding, and students who studied in the same environment with the (external) design pattern of scaffolding in the post measurement of Cognitive test of producing interactive infographic skills. This is due to the primary impact of scaffolding design pattern used.

4. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with the (internal) design pattern of scaffolding, and students who studied in the same environment with the (external) design pattern of scaffolding in the post measurement of Rubric cards of producing interactive infographic skills. This is due to the primary impact of scaffolding design pattern used.
5. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of students in the four experimental groups in the post measurement of Cognitive test of producing interactive infographic skills. This is due to the impact of interaction between scaffolding source (human-intelligent) and scaffolding design pattern (internal-external).
6. There are no statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of

students in the four experimental groups in the post measurement of Rubric cards of producing interactive infographic skills. This is due to the impact of interaction between scaffolding source (human–intelligent) and scaffolding design pattern (internal–external).

Research Tools:

First: Tools for Collecting Data:

- Interview with the second–year students of education technology department to find out the real problem.
- List of interactive infographic production skills.
- List of criteria for designing an e–learning environment based on gamification with two sources and two design patterns of scaffolding.

Second: Measurement Tools:

- Cognitive test of producing interactive infographic skills.
- practical performance test of producing interactive infographic skills.
- Rubric cards of producing interactive infographic skills.

Third: Experimental Treatment Tools:

- E–learning environment based on gamification with scaffolding source (human), and scaffolding design pattern (internal).
- E–learning environment based on gamification with scaffolding source (human), and scaffolding design pattern (external).

- E-learning environment based on gamification with scaffolding source (intelligent), and scaffolding design pattern (internal).
- E-learning environment based on gamification with scaffolding source (intelligent), and scaffolding design pattern (external).
- Validity assessment card for e-learning environment based on gamification with scaffolding source (human-intelligent) and scaffolding design patterns (internal-external)

Research Steps and Procedures:

First: An Analytic Study of the Theoretical Framework:

- Reviewing and analyzing literature and previous studies related to the field of research and its aspects represented in: (gamification in e-learning environments, scaffolding two sources "human by teacher and intelligent by chatbots", and two scaffolding design patterns "inside e-learning environment based on gamification and outside the environment in Facebook messenger", interactive infographic production skills).
- creating educational content for interactive infographic production skills.

Second: An Experimental Developmental Study:

The study has passed through a number of procedural designing steps to design the experimental treatments, study tools, their experimentation, and collecting results and interpretation through making use ADDIE, the general model of educational design, the researcher has modified the sub-steps included in the basic stages to suit the learning environment.

Research Results:

1. There were statistically significant differences at significance level $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with the (human) source of scaffolding, and students who studied in the same environment with the (intelligent) source of scaffolding in the post cognitive test of producing interactive infographic skills, in favor of the experimental group that studied with intelligent scaffolding, except for the evaluation level, there are no differences.
2. There were statistically significant differences at significance level $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with the (human) source of scaffolding, and students who studied in the same environment with the (intelligent) source of scaffolding in the post measurement of Rubric cards of producing interactive infographic skills, this is due to the primary impact of scaffolding source used, in favor of the experimental group that studied with intelligent scaffolding.

3. There were statistically significant differences at significance level $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with (internal) design pattern of scaffolding, and students who studied in the same environment with (external) design pattern of scaffolding in the post cognitive test of producing interactive infographic skills, In favor of the experimental group that studied with internal scaffolding design pattern, and there were no differences for the level of remembering and understanding.
4. There were statistically significant differences at significance level $\leq (0.05)$ between the mean scores of students who studied in an e-learning environment based on gamification with (internal) design pattern of scaffolding, and students who studied in the same environment with (external) design pattern of scaffolding in the post measurement of Rubric cards of producing interactive infographic skills, this was due to the primary impact of scaffolding design pattern used.
5. There were statistically significant differences at the level of significance $\leq (0.05)$ between the mean scores of students in the four experimental groups in the post measurement of Cognitive test and Rubric cards of producing interactive infographic skills, this is due to the impact of interaction between scaffolding source (human-intelligent) and scaffolding design pattern (internal-external), and the order

of the four groups was as follows: (intelligent–internal), then (human–external), then (intelligent–external), then (human–internal).

Research Recommendations:

the research recommends the following:

- Applying the e-learning environment based on gamification designed by the researcher in teaching different educational courses.
- Including human and intelligent scaffolding tools – which was designed by the researcher – with electronic scaffolding tools in curricula of different faculties.
- Providing the infrastructure for applying e-learning environments based on gamification, by preparing trained human cadres, providing Internet connections, computers and periodic maintenance for them.
- Utilizing the design criteria formulated in this research to design e-learning environments based on gamification, and electronic human and intelligent scaffolding tools.
- Inclusion of training on designing and producing interactive infographics skills within the faculties of education's curricula and within the matrix of training programs offered by the Professional Academy for Teachers.

Suggested Researches:

- Study the impact of different response patterns of chatbots on developing decision-making skills among educational technology students.
- Study variables of human and intelligent scaffolding with other student interaction interfaces, as independent variables and their impact on developing the skills of producing interactive infographic.
- Study the effect of providing peer and teacher scaffolding through audio and video communication between students only and between them and the teacher on other dependent variables.
- Study the impact of intelligent scaffolding using chatbots in MOOCs.
- Study the impact of intelligent scaffolding using chatbots in Mobile Learning.
- Study the impact of integrating human and intelligent scaffolding with simulation and virtual reality environment.
- A study on developing criteria of human and intelligent.
- A study on developing criteria of e-learning environment based on gamification.
- More studies on integrating different types of scaffolding in e-learning environments.